Application of Ground Water Dating Techniques for Evaluating the Susceptibility of Aquifers and Public-Supply Wells to Contamination

Sandra Eberts[1], John Karl Böhlke[2], Leon Kauffman[3]
[1] USGS, 6480 Doubletree Avenue, Columbus, OH, 43229
[2] USGS, 431 National Center, Reston, VA, 20192
[3] USGS, 810 Bear Tavern Road, Suite 206, West Trenton, NJ, 08628

Biographical Sketches
Sandra Eberts has been a hydrologist with the U.S. Geological Survey for over twenty years. She is currently team leader of the USGS National Water-Quality Assessment program Transport of Anthropogenic and Natural Contaminants to Supply Wells (TANC) topical study. Prior to her work on the TANC study, Sandra spent 8 years as a technical liaison to the U.S. Air Force for the clean-up of groundwater contamination at weapons manufacturing facilities nationwide.

Dr. John Karl Böhlke is a Research Hydrologist in the USGS National Research Program in Water Resources. He received his PhD degree in Geology and Geophysics at the University of California, Berkeley, and has worked for the Geologic Discipline and the Water Resources Discipline at USGS for approximately 20 years, specializing in geology and geochemistry. His published work includes field and laboratory-based studies of water-rock interactions, geochronology of rocks and groundwaters, and contaminant transport in diverse hydrogeologic settings, with recent emphasis on application of isotopes and other environmental tracers to track nitrate and related compounds in the near-surface environment.

Leon Kauffman has been a hydrologist with the U.S. Geological Survey for ten years. He currently is part of the Hydrologic Systems Team of the National Water Quality Assessment program providing technical support for various ground-water modeling activities. His research interests include coupling models, spatial data, and water quality results to better understand ground-water systems.

Abstract
Scientists with the USGS National Water-Quality Assessment Program evaluated age-dating techniques for their utility in screening aquifers and public-supply wells (PSWs) for susceptibility to contamination; four principal-aquifer settings (Central Valley, Floridan, Glacial Deposits, High Plains) were addressed. Multiple environmental tracers (sulfur hexafluoride, chlorofluorocarbons, tritium/helium-3, tritium) were compared with ground-water age distributions generated by use of lumped parameter models and numerical flow models for PSWs and for monitoring wells installed throughout their contributing areas. Results for samples collected at multiple depths within several of the PSWs during pumping also were compared with results from nested monitoring wells adjacent to the PSWs.

Young water (less than 50 years old) was detected in all of the PSWs. Comparison of environmental tracer data with lumped-parameter models and numerical flow models indicate a variety of age distributions in which young water in the PSWs ranged from 20 to nearly 100 percent of the water produced. Comparison of the dating results from the PSWs and monitoring wells, in combination with the age distributions from the numerical flow models, provides insight into which PSWs contain young water consistent with recharge from their simulated contributing

areas and which contain young water drawn down locally by short circuiting through natural conduits (such as sink holes) or anthropogenic features (such as irrigation wells). This additional knowledge of where and how young waters actually enter PSWs, which is facilitated by understanding the distribution of ground-water ages in the surrounding aquifer, may be necessary to develop monitoring strategies and plans that are capable of protecting PSWs from contamination.